REMARKS

Claims 1, 2, 6-11, 13-16 and 22-38 currently appear in this application. The Office Action of October 28, 2002, has been carefully studied. These claims define novel and unobvious subject matter under Sections 102 and 103 of 35 U.S.C., and therefore should be allowed. Applicants respectfully request favorable reconsideration, entry of the present amendment, and formal allowance of the claims.

The claims have been modified to recite the method by which the surface of the substrate/chip is modified. Support for these amendments can be found in the specification as filed at page 7, lines 6-20.

Claim 16 is rejected under 35 U.S.C. 102(b) as being anticipated by Chrisey et al.

This rejection is respectfully traversed. While Chrisey et al. disclose a chip for amplifying and immobilizing DNA, the Chrisey et al. substrates explicitly require organosilanes on the surface thereof. On Chrisey et al., the synthetic hybridizable nucleic acid is able to form only on the selected portion of the surface of the substrate.

In contrast thereto, the chip of the present invention does not require organosilane , and DNA is able to form on all portions of the surface of the chip because of the treatment of the surface of the chip.

Claims 1, 2, 4, 5, 9-11, 13-15 and 25 are

rejected under 35 U.S.C. 103(a) as being unpatentable over Chrisey et al. as defined by Sumiya et al. in view of Fodor et al.

With respect to claim 1, Chrisey et al. teach a solid state substrate for DNA immobilization which explicitly requires organosilane. The synthetic hybridizable nucleic acid is only able to form on selected portions of the surface of the Chrisey et al. substrate.

In contrast thereto, a chip according to the present invention does not require organosilane; the entire surface of the chip is treated so that DNA is able to form on the entire surface of the chip.

Fodor et al. add nothing to Chrisey et al. to disclose or suggest the surface as claimed herein. While Fodor et al. disclose a roughened surface on the substrate, the photosensitive protecting groups are removed by irradiation with light in the ultraviolet or visible part of the electromagnetic spectrum. In the case of the present invention, however, the surface of the solid state substrate is chloridized by irradiating the substrate with ultraviolet light in the presence of chlorine gas. In the present invention, ultraviolet light is used to remove protecting groups, while in the present invention ultraviolet light is used to couple groups to the surface of the substrate.

With respect to claims 9, 10, and 11 (Claims 4 and 5 having been cancelled by the present amendment), the Chrisey et al. substrates explicitly require the presence of

organosilane on the surface thereof, and synthetic hybridizable nucleic acids are able to form only on selected portions of the surface of these substrates.

The chip of the present invention does not require the presence of silane, and hybridizable nucleic acids can be formed over the entire surface of the chip.

Regarding claim 13, Chrisey et al. teach a solid state substrate for DNA immobilization which explicitly requires organosilane. The synthetic hybridizable nucleic acid is only able to form on selected portions of the surface of the Chrisey et al. substrate. Fodor et al. add nothing to this disclosure, as Fodor et al. merely disclose that the surface of a chip can be roughened.

In contrast thereto, a chip according to the present invention does not require organosilane; the entire surface of the chip is treated so that DNA is able to form on the entire surface of the chip.

Claims 6-8 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chrisey as defined by Sumiya et al. in view of Fodor et al. and further in view of Kobashi.

This rejection is respectfully traversed. Kobashi adds nothing to the disclosures of Chrisey et al, Sumiya et al., and Fodor et al. Kobashi relates to a sensor that can be used to detect the presence of biological or chemical compounds. The biosensor of Kobashi contains a diamond film and a transducer. The generally accepted definition of a

transducer is "a substance or device, such as a piezoelectric crystal, microphone, or photoelectric cell, that converts input energy of one form into output energy of another." There is no transducer on the chip of the present invention, and there is no intention to serve as a basis for DNA or protein amplification.

In view of the above, it is respectfully submitted that the claims are now in condition for allowance, and favorable action thereon is earnestly solicited.

Respectfully submitted,

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1. (Fourth Amendment) Solid state substrate adapted and configured for DNA immobilization, said solid state substrate having a thermal conductivity ratio of at least 0.1W/cmEK for amplifying and immobilizing DNA,

wherein the surface of the substrate is modified **polar radical at the surface of the substrate** by binding a chloride ~~or~~ **by irradiating the surface of the substrate with ultraviolet light in an atmosphere of chlorine gas to bind chloride to the substrate, and replacing the chloride by** a hydroxyl radical ~~to the substrate, and~~

~~wherein the surface of the solid state substrate is roughened~~**by dipping the substrate into a boiling alkali solution or steam, or by binding an amino radical to the subsrate by irradiating the substrate with ultraviolet light in an ammonia gas atmosphere, or by binding a carboxyl radical to the substrate by dipping the substrate into a solution containing a carboxyl radical or an epoxy radical**.

2. (Twice Amended) A substrate as claimed in claim 1, wherein said substrate is natural diamond**,** ~~or~~ synthetic diamond**, or diamond-like carbon**.

6. (Twice Amended) The substrate as claimed in claim ~~5~~**1**, wherein said polar radical is a carboxyl radical and said carboxyl radical is connected on a surface of said substrate through ester linkage.

7. (Twice Amended) The substrate as claimed in claim ~~5~~1, wherein said polar radical is a carboxyl radical and said carboxyl radical is connected on a surface of said substrate through amide linkage.

8. (Twice Amended) The substrate as claimed in claim ~~5~~1, wherein said polar radical is a carboxyl radical and said carboxyl radical is introduced to a surface of said substrate with a silane coupling agent, a titanium coupling agent or an aluminum coupling agent.

9. (Twice Amended) The substrate as claimed in claim ~~5~~1, wherein said polar radical is an epoxy radical and said epoxy radical is introduced to a surface of said substrate with a silane coupling agent, a titanium coupling agent or an aluminum coupling agent.

10. (Twice Amended) The substrate as claimed in claim ~~5~~1, wherein said polar radical is an amino radical and said amino radical is introduced to a surface of said substrate with a silane coupling agent, a titanium coupling agent or an aluminum coupling agent.

13. (Third Amendment) A solid state substrate having DNA immobilized thereon, wherein said substrate is diamond or diamond like carbon and is chemically modified by

binding a chloride ~~or~~ **by irradiating the substrate with ultraviolet light in a chlorine gas atmosphere, and then replacing the chloride with** a hydroxyl radial ~~to the substrate, and the substrate has a roughened surface~~**by dipping the substrate into a boiling alkali solution or steam, or an amino radical by irradiating the substrate with ultraviolet light in an atmosphere ammonia gas, or a carboxyl radical by dipping the substrate into a solution containing a carboxyl radical or an epoxy radical**.

16. (Twice Amended) A chip for amplifying and immobilizing DNA **wherein the surface of the chip is modified by binding a chloride by irradiating the chip with ultraviolet light in an atmosphere of chlorine gas, and replacing the chloride by a hydroxyl radical by dipping the chip into a boiling alkali solution or steam, or an amino-radical by irradiating the chip with ultraviolet light in an atmosphere of ammonia gas, or a carboxyl radical by dipping the chip into a solution containing a carboxyl radical or an epoxy radical**.